MDCC 2016
中国移动开发者大会
Mobile Developer Conference China 2016

# Unity PSVR开发优化

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# 今日内容

- Unity如何支持VR开发
- 对VR渲染的底层优化
- Unity PSVR开发优化
- Unity VR开发路线图

▶ AVAILABILITY VR MR

## Facebook

▶ NOW

In 2014, Facebook bought Oculus, the company that dreamed up the Rift headset and (literally) kick-started the VR revolution. Read more

## HTC

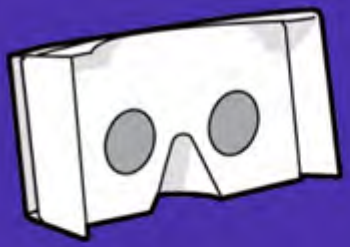
▶ NOW

The Taiwanese phone manufacturer teamed up with game maker Valve Software to launch a high-end headset, the HTC Vive. Read more

## Sony

▶ OCTOBER 2016

Unlike the Rift and the Vive, Sony's PlayStation VR is designed to work not with a PC but its own game console—which more than 36 million already own. Read more



## Google

▶ NOW

Google created Cardboard, its cheap assemble-it-yourself viewer, to bring virtual reality to the masses via their smartphones. Read more

## Samsung

▶ NOW

The Gear VR straps a Galaxy smartphone (new models only) to your head to deliver games and apps—all powered by Oculus software. Read more

## OSVR

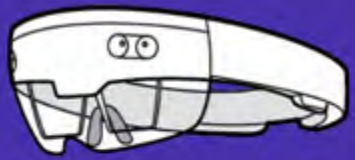
▶ DEV KIT AVAILABLE

An open source platform for VR and MR launched in 2015 and backed by a consortium of companies like Intel and gaming outfit Razer. Read more

## Fove

▶ FALL 2016

This startup proposes to use eye tracking to sharpen what you focus on and blur everything else, cutting down on processing power.



## Microsoft

▶ DEV KIT AVAILABLE

The company's HoloLens is a wireless, wearable, sensor-packed computer that aggregates its data to embed holograms in the user's environment. Read more

## Meta

▶ DEV KIT, FALL 2016

Initially funded via Kickstarter in 2013, the startup has created a visor that projects virtual interactive displays in the wearer's field of vision.

# Unity如何支持VR开发

# Unity支持的两种VR整合模式

- 第三方插件
  - 通常由第三方硬件厂商提供SDK
  - 需要渲染左眼+右眼, 需要双倍的CPU/GPU渲染成本

- Unity原生支持VR模式
  - 直接将对第三方硬件的支持集成于Unity中
  - 可以直接在底层对设备进行渲染管线的优化, 可以尽量做到左右眼一起渲染

Oculus Rift

Gear VR

Playstation VR

Steam VR/HTC Vive

unity


Google Cardboard

Microsoft

Hololens

unity

**Unity 5.1 – 2015-06-09** 开始拥有统一的VR接口

**Unity 5.2 – 2015-09-08** 添加对PSVR的支持

**Unity 5.3 – 2015-12-08** 添加一些新的VR功能

- 用户可以重写Head Tracking（view matrix + FOV）

**Unity 5.4 – 2016-07-28** 很多新的VR功能

- 同时支持多种VR设备
- Single-Pass Stereo Rendering
- Graphics Jobs (Experimental)

# 原生支持多种VR设备

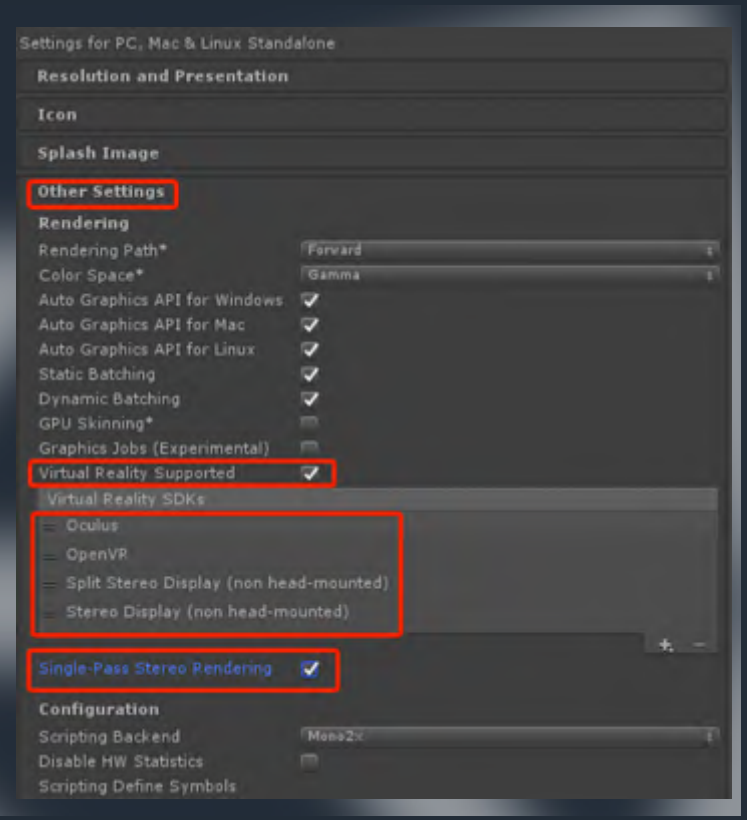
- 最新的Unity 5.4版本支持Oculus, GearVR, OpenVR (SteamVR/HTC Vive) 和 Playstation VR（PSVR需要单独设置）
- 提供统一API用于和不同的VR设备进行交互
- 无需添加额外的SDK（因为已经集成到Unity了）
- 可以在同一个项目中切换不同的设备做测试
- 统一的底层优化（例如：Single-Pass Stereo Rendering）

# 主要的Unity VR Classes

- **UnityEngine.VR**
  - InputTracking – 用于控制HMD的不同模块
  - VRDevice – 获取所支持设备的基本信息, 型号, 刷新率等信息
  - VRSettings – 用于修改所支持设备和改变 Eye Texture 尺寸
  - VRStats – 用于获取GPU frame time的接口 (目前支持OpenVR, 对PSVR的支持正在开发中)

# 主要的Unity VR Classes (续上一页)

- **UnityEngine.PS4.VR**
  - PlayStationVR – 用于和PSVR头盔交互
  - Tracker – 用于和所跟踪的controller和头盔移动数据交互
  - HMDSetupDialog – 对PSVR设置信息查询对话框的封装
- **UnityEngine.PS4**
  - PS4Input – 用于获取DUALSHOCK®4 和 PS Move Controller信息




# Oculus&OpenVR开发选项

- Oculus支持Oculus Rift & GearVR开发
- OpenVR支持SteamVR & HTC Vive开发
- 使用OpenVR需要先安装Steam和SteamVR

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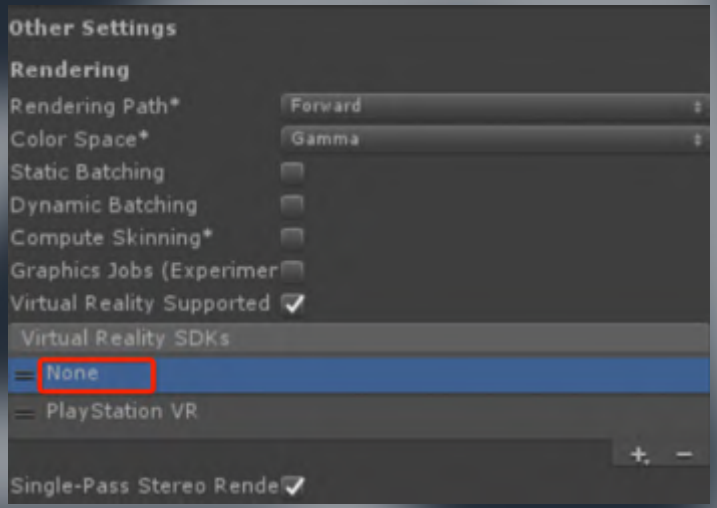
# PSVR开发选项




- 列表上的None表示项目开始运行的时候不会直接进入VR模式，在这里你可以检测头盔是否已经正确连接，然后再过渡进入VR模式
- 如果是处于开发阶段，可以直接把Playstation VR选项放到上面，这样就直接进入VR模式

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# Virtual Reality Supported选项打开以后

- 如果头盔连接着电脑, 系统会自动把相机所看到的画面渲染到HMD头盔
- 你也可以使用摄像机上组件上的 stereoTargetEye 属性来禁用直接渲染到HMD
- 头部移动跟踪和适合于所连接设备的Filed of View (FOV)会自动设置好

# Single-Pass Stereo Rendering

- 改变了之前先渲染左眼，再渲染右眼的模式，一次性完成两只眼睛的渲染
- 通常情况下可以把Main Thread上的渲染时间减半，也可以降低Render Thread上所消耗的渲染时间
- 有一些脚本和Image FX可能不工作，要具体项目具体分析

# Standard Two Pass VR

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# Single Pass VR

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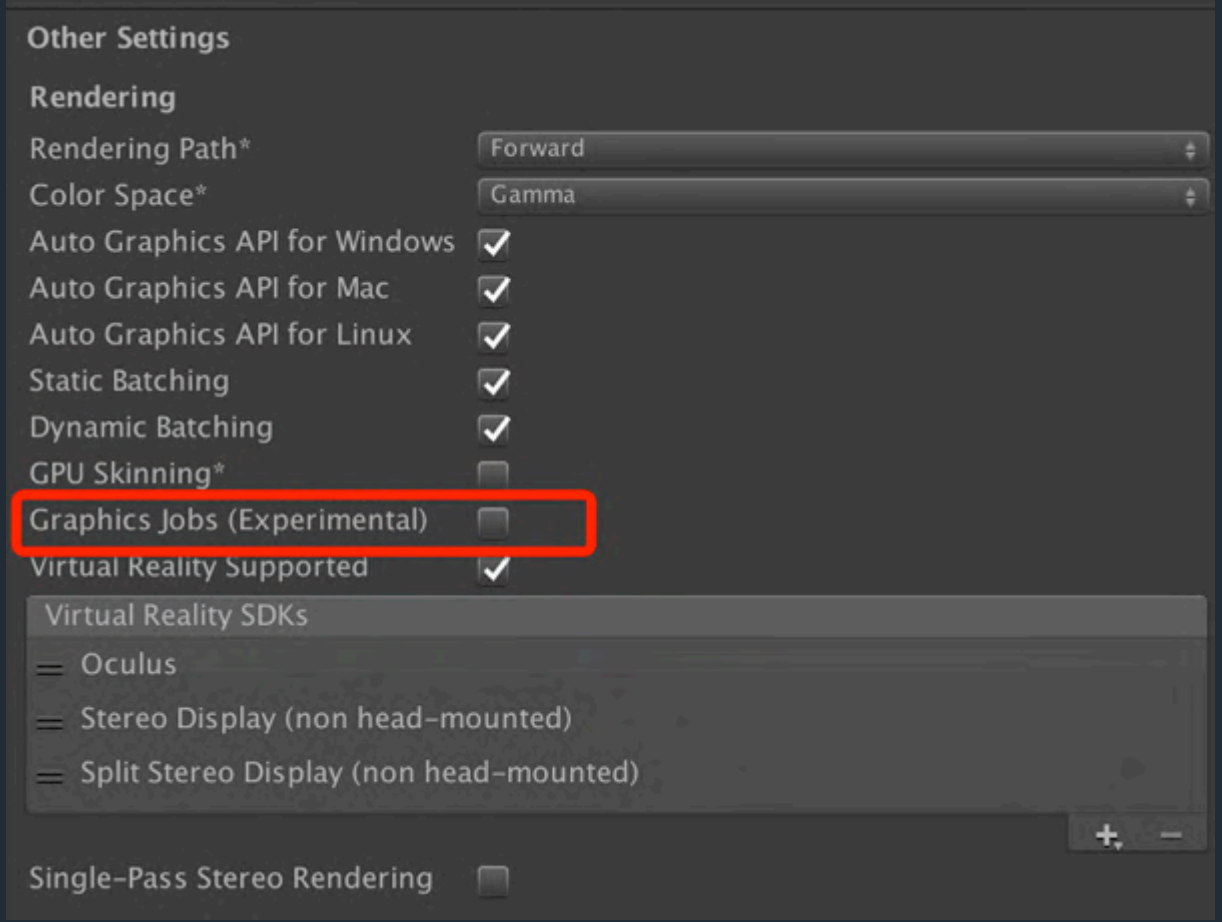
# Graphics Jobs

- 5.4系列版本里面的试验性功能
- 将Main Thread上的渲染工作分配一部分给Worker Threads，这可以大幅减轻Main Thread占用的CPU
- Forward Rendering和Deferred Rendering完全支持Graphic Jobs

| Render Mode | Graphics Jobs Support |
| --- | --- |
| Forward Rendering | Full. |
| Deferred Rendering | Full. |
| Legacy Deferred | None. |


Other Settings
Rendering
Rendering Path*
Forward
Color Space*
Gamma
Auto Graphics API for Windows
Auto Graphics API for Mac
Auto Graphics API for Linux
Static Batching
Dynamic Batching
GPU Skinning*
Graphics Jobs (Experimental)
Virtual Reality Supported
Virtual Reality SDKs
Oculus
Stereo Display (non head-mounted)
Split Stereo Display (non head-mounted)
Single-Pass Stereo Rendering

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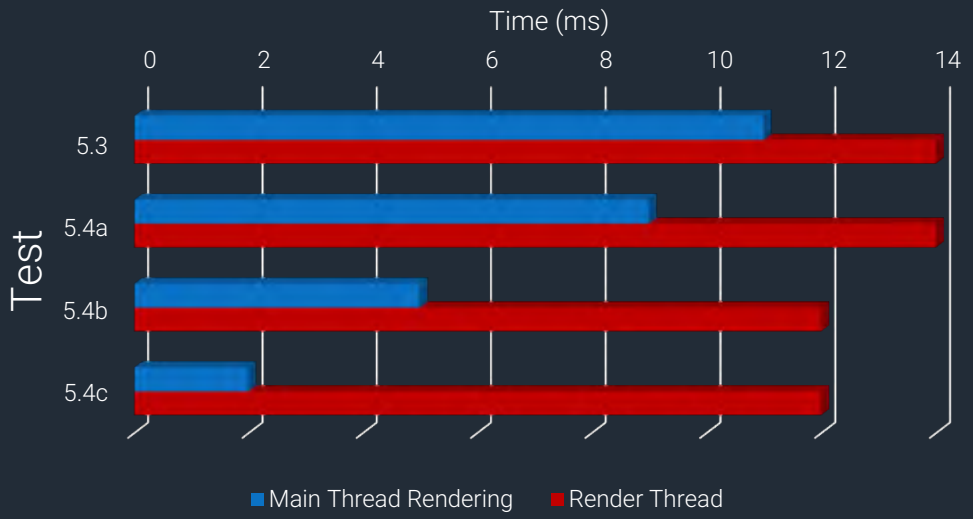
# Performance Test




5.4a Unity 5.4 two pass VR.

5.4b Unity 5.4 Single Pass VR.

5.4c Unity 5.4 Single Pass VR + Graphics Jobs enabled.

Note: Performance increases shown here are for an ideal case. They may well vary from project to project depending on the type of content you are rendering and how you are rendering it.

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# PSVR专属更新 – HTile Culling

- 当用Unity内置的Playstation®VR进行渲染时，Unity会应用Htile Culling功能
- 此功能可以把因为Lens Distortion导致的，处于最终渲染帧外围的区域，在早期就剔除掉
- 可以剔除大约17%的像素，节省GPU pixel shader time
- 下图的紫色区域就是被剔除的区域：

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# 其他5.4版本中的功能

- 混合模式的阴影 (Static + Dynamic).
  - 可以烘焙更多的光源，从而提高渲染速度
- 基本的Instancing支持
  - PS4™现在支持了
  - 不过目前这个还不是Standard Shader自动支持的功能，需要自己写着色器.
- 点光源衰减相关的画面质量改善
- 显著改善PS4上运行Profiler的效能：现在在PS4上使用Unity Profiler获得的结果更准确了
- 普遍降低了在主线程上的渲染时间

# PSVR 开发优化

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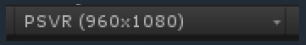
# 工作流和迭代

- 无法直接戴上头盔在编辑器里面预览
- 可以通过脚本用鼠标来模拟头盔移动：
  - Horizontal field of view ~= 100 degrees
  - Game size (960x1080)
  - Omni camera controller 

- 或者使用其他头盔来做测试
- 尽量多做测试
  - 对单个场景做测试
  - 如果代码量大的话可以打包成 DLL 以避免长时间重新编译
- 未来: VR Remote

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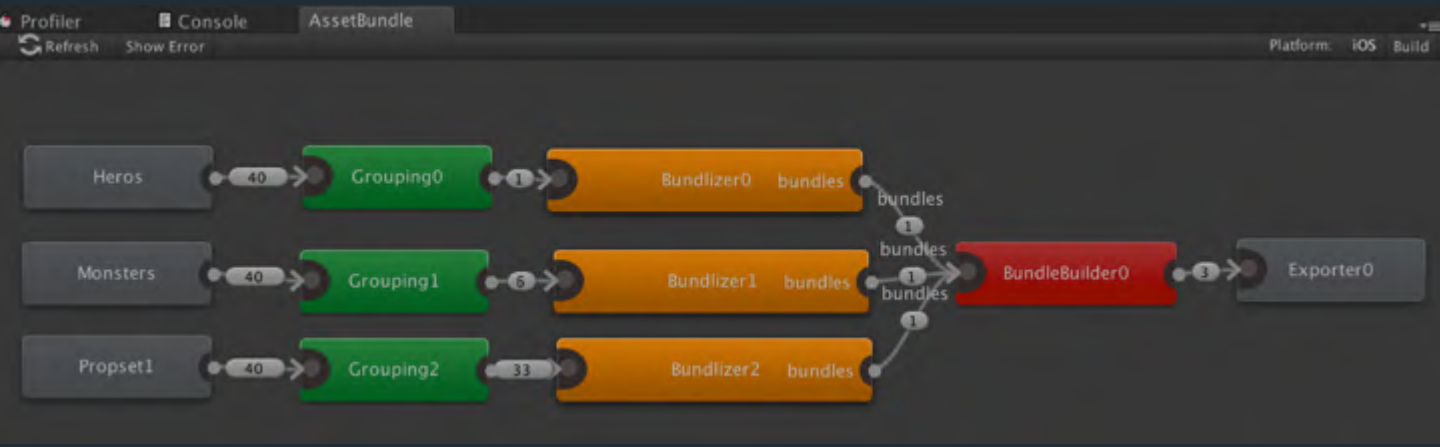
# AssetBundle资源管理

- 建议开发阶段用Resources文件夹来动态加载资源
- 使用AssetGraph来管理AssetBundle打包：
  https://github.com/unity3d-jp/AssetGraph



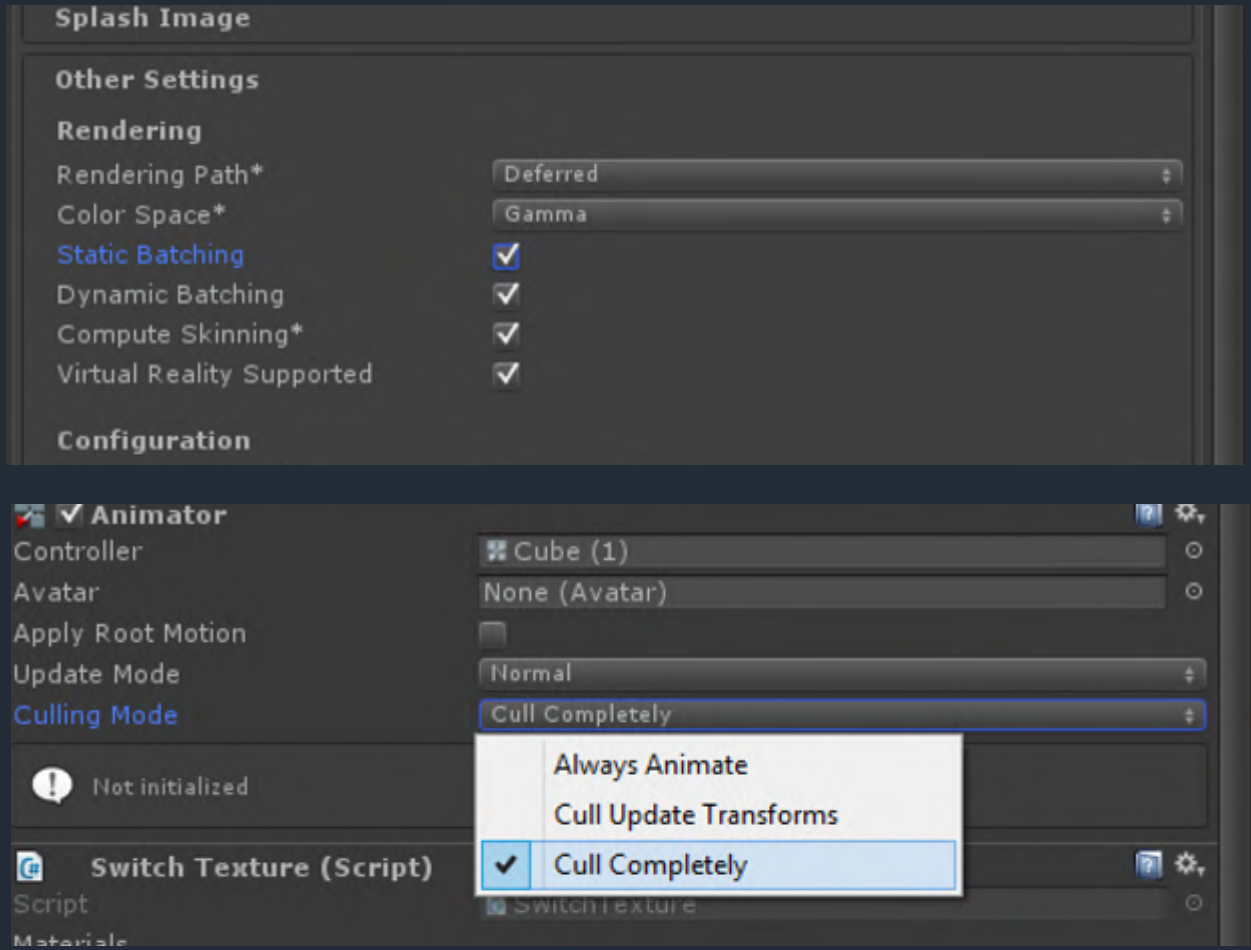
# 性能分析

- 使用 RAZOR GPU/CPU (在Playstation settings中打开)
- Development build + Unity profiler + CPU time-line view（5.0版本开始的功能）
- FrameDebugger
  - Unity编辑器原生支持
  - Remote FrameDebugger works on PS4（如果PSVR打开的话则不工作）
- FPS counter (Standard assets + World space UI)

# 提升性能

- 系统压力: 2 eyes + wide field of view + high resolution + high frame rate + reprojection

- CPU:
  - 不要同时呈现过多的GameObject
    http://blogs.unity3d.com/2015/12/23/1k-update-calls/
  - 用GPU Skinning来替代CPU Skinning
  - 不要更新看不到的物体
  - 简单动画可以用PlayableAPI来播放，而不需要创建一个只有一个状态的Animator Controller


Splash Image
Other Settings
Rendering
Rendering Path*
Deferred
Color Space*
Gamma
Static Batching
Dynamic Batching
Compute Skinning*
Virtual Reality Supported
Configuration
Animator
Controller
Cube (1)
Avatar
None (Avatar)
Apply Root Motion
Update Mode
Normal
Culling Mode
Cull Completely
Not initialized
Always Animate
Cull Update Transforms
Cull Completely
Switch Texture (Script)
Script
Materials

# 提升性能

- Fillrate / overdraw:
  - 可以通过 Material.renderQueue，控制物体的渲染次序
  - http://docs.unity3d.com/ScriptReference/Rendering.OpaqueSortMode.html 通过摄像机的这个属性，可以提升CPU的使用效率
- Drawcalls (=batches)
  - Static + Dynamic batching + combine mesh + texture atlas + common material + material property blocks + Large Lightmap atlas 尺寸，可以避免
  - 使用FrameDebugger

# 灯光和阴影

- Lights:
  - 减少光源 (eg: <=2)
  - 减小光源半径大小
  - 动态灯光效果尽量只用在比如爆炸效果等地方
- Shadows:
  - 使用Lightmap做烘焙
  - 最好不要有动态阴影
  - Mixed mode static + dynamic improved in 5.4版本中
  - 可以在Quality Setting里减小阴影距离
  - 可以在使用老式的阴影效果 (=decals贴花方式, vertex shader)
  - 或者使用自定义的阴影 (可以参考AssetStore里面的BlackSmith角色资源)

# Image FX in VR

- Depth of field
- Lens flare
- SSRR (Too expensive, strong aliasing)

- Blur
- Temporal AA (Deactivate temporal to save performance and prevent ghosting)

- Bloom
- Tone mapping, color grading
- Vignette

# https://bitbucket.org/Unity-Technologies/cinematic-image-effects/

# 在VR里应用粒子效果

- 适合使用小规模粒子效果
- 大型粒子效果会看上去很假
- 解决方案：
- 1. DrawMesh
- 2. Compute Shaders

# UI in VR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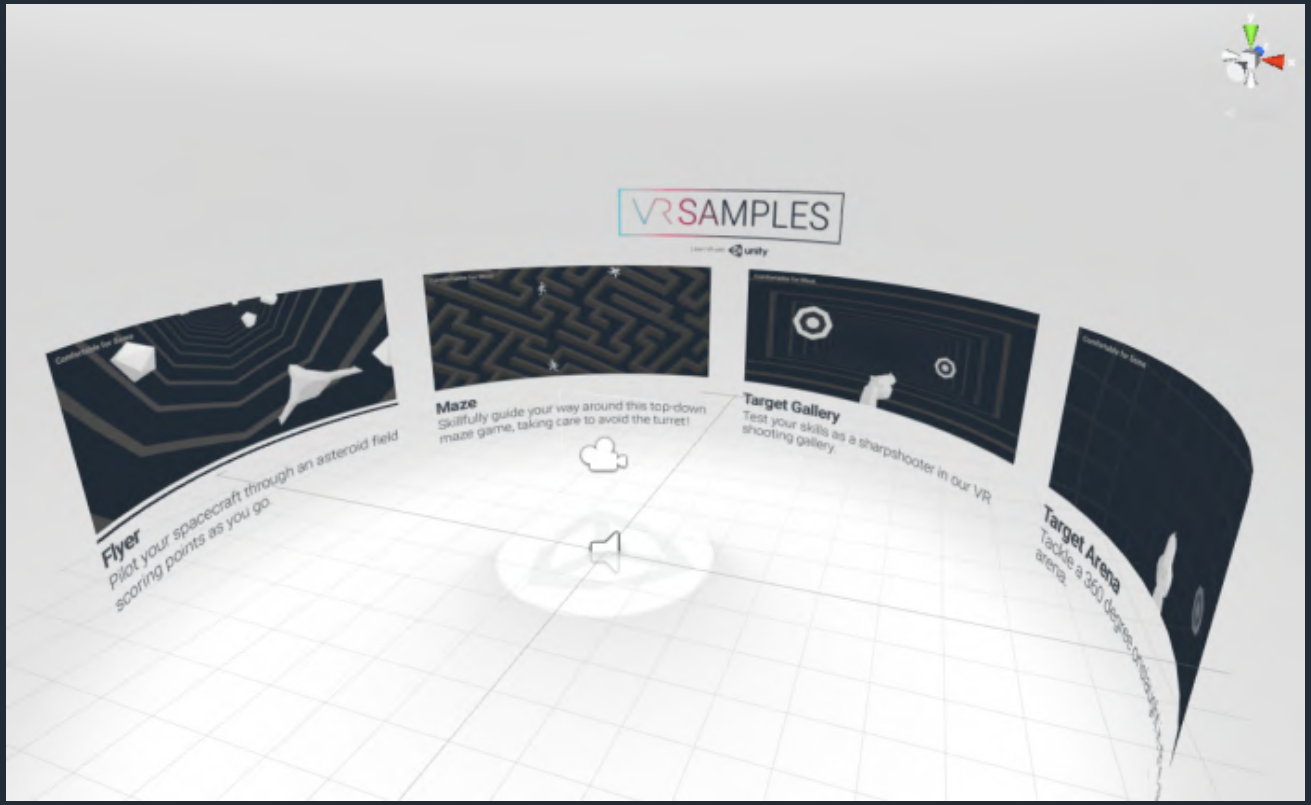
VR SAMPLES
Flyer
Pilot your spacecraft through an asteroid field scoring points as you go.
Maze
Skillfully guide your way around this top-down maze game, taking care to avoid the turret!
Target Gallery
Test your skills as a sharpshooter in our VR shooting gallery.
Target Arena

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# Maze

Guide your character to the exit

**SWIPE** or use **LEFT/RIGHT** to rotate the maze
**DOUBLE-TAP** to move

Ok, I got it!

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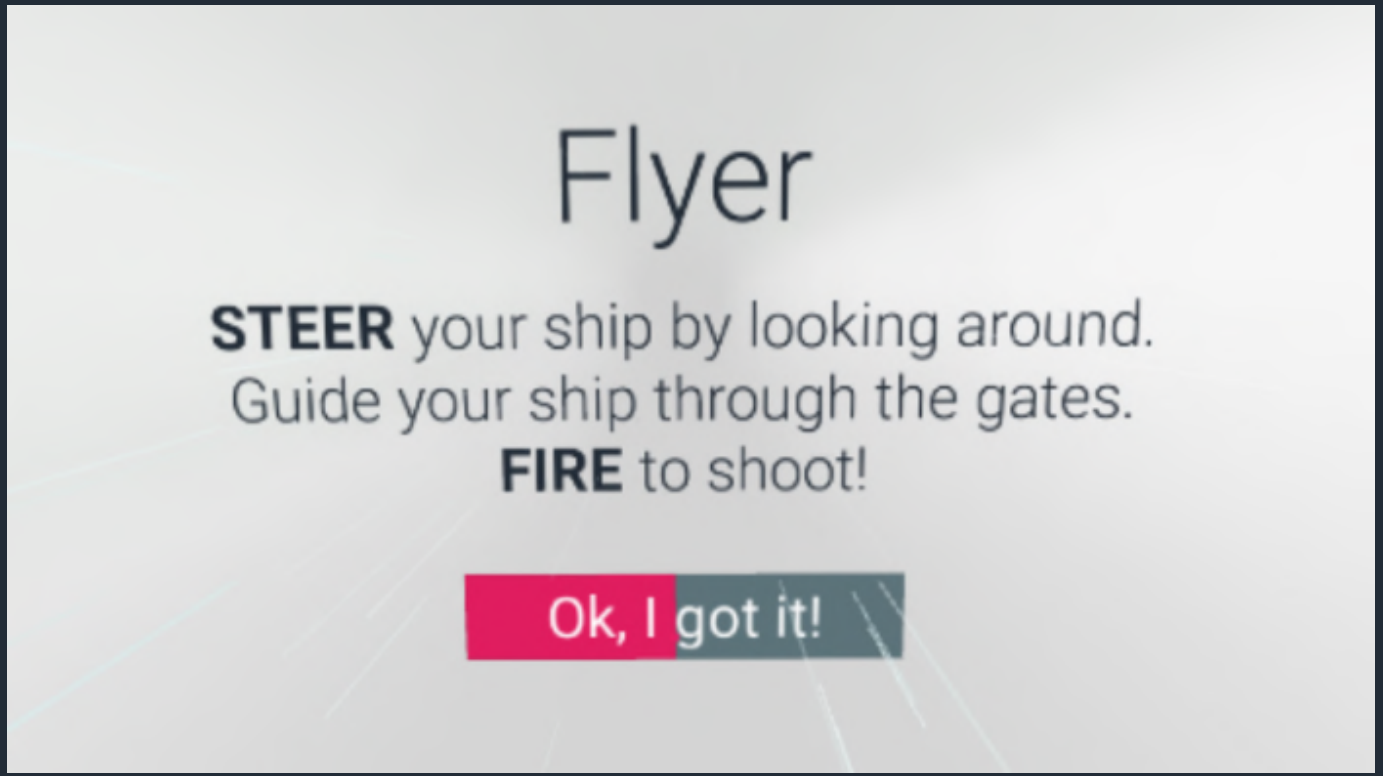
TIME
Score: 0
HEALTH


Flyer
STEER your ship by looking around.
Guide your ship through the gates.
FIRE to shoot!
Ok, I got it!

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Target Arena
Press FIRE to shoot the
targets within the time limit
Ok, I got it!

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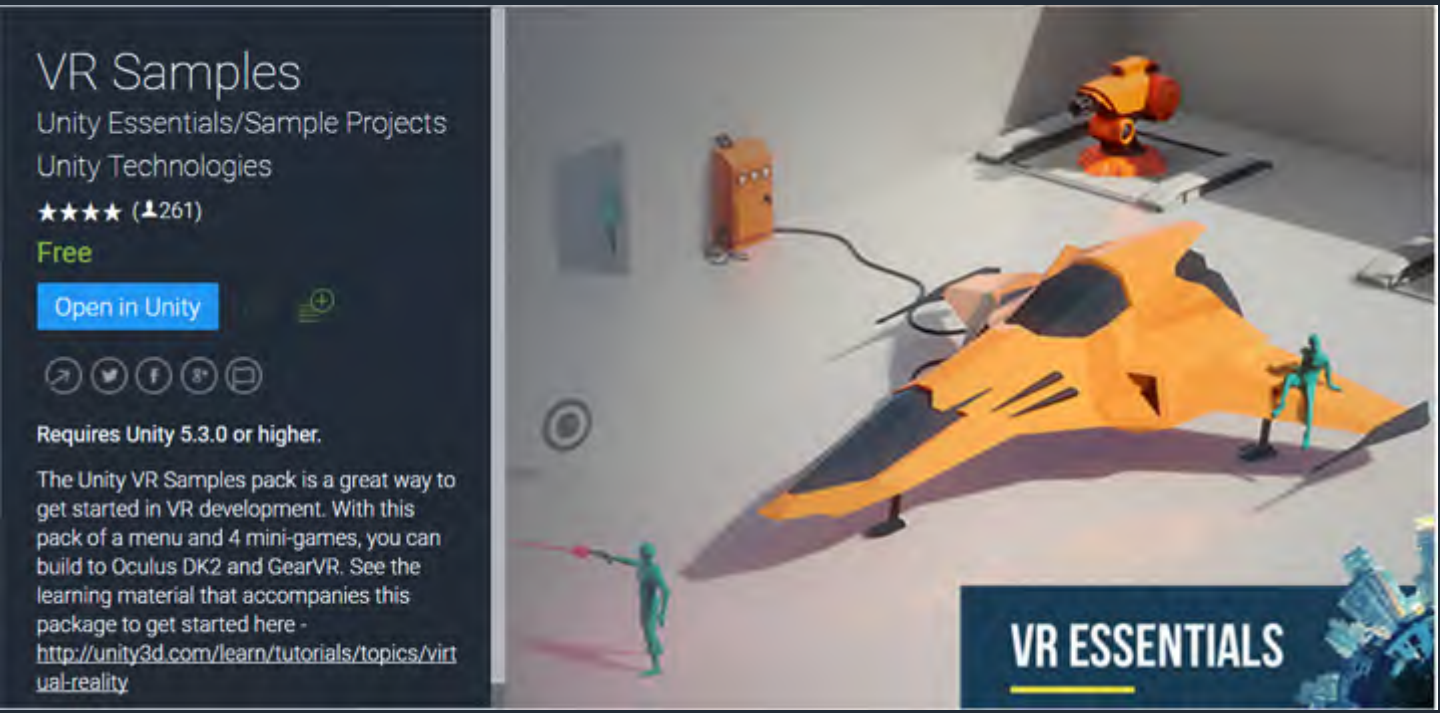
# https://www.assetstore.unity3d.com/en/#!/content/51519

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# 改变场景或者物体的大小

- 不要缩放整个场景 (因为Unity是1个Unit对应1米，包括物理系统，NavMesh，GI等)
- 缩放摄像机的父物体，会增加两眼之间的距离；同时也会增加摄像机的positional tracking scale - 如果真要缩放要当心，因为可能会增加不适感
- 目前还没有API用于设置IPD（左右瞳孔间距）

# Unity VR开发路线图

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- 进一步提升Single-Pass Stereo Rendering的效能，提升Render Thread time和GPU time
- 跨平台支持多种跟踪设备
- Unity Remote：允许编辑器直接将VR图像传输给PSVR，然后获取头部移动数据返回到编辑器，方便用户直接在编辑器里面戴着头盔做VR开发
- 提供更多面向艺术家的工具，例如以下视频所展示的：


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2016.12.14-15
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# 谢谢

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